

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Agnello, et al.

Examiner: Vu, Hung K.

Serial No.: 09/939,895

Art Unit: 2811

Filing Date: 8/27/2001

Title: **WET CLEANS FOR COBALT DISILICIDE PROCESSING**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

BRIEF OF APPELLANT

This Appeal Brief, pursuant to the Notice of Non-Compliant Appeal Brief Mailed November 7, 2007, is pursuant to the Notice of Appeal filed September 2, 2004 and becoming effective on September 28 when the present patent application was revived from abandonment, is an appeal from the rejection of the Examiner in the final office action dated June 4, 2003.

REAL PARTY IN INTEREST

International Business Machines, Inc. is the real party in interest.

RELATED APPEALS AND INTERFERENCES

None.

STATUS OF CLAIMS

Claims 27, 33-34, and 39-44 are rejected. 28-31 and 35-38 are withdrawn. Claims 1-26

and 32 are canceled.

STATUS OF AMENDMENTS

There are no After-Final Amendments which have not been entered.

SUMMARY OF CLAIMED SUBJECT MATTER

Claim 27 - INDEPENDENT

The present invention provides a structure, comprising a layer of cobalt disilicide (44) and a layer of silicon (33), wherein the layer of cobalt disilicide is on the layer of silicon, wherein the layer of cobalt disilicide is substantially free of cobalt monosilicide, wherein there is essentially no stringer of an oxide of titanium on the layer of cobalt disilicide, and wherein the layer of cobalt disilicide is in contact with a reagent comprising water, ammonium hydroxide, and hydrogen peroxide. See FIG. 10 and specification, page 9, lines 10 - 18.

Claim 34 - INDEPENDENT

The present invention provides a structure having a substrate, wherein the substrate includes an insulated-gate field effect transistor (FET) (49), wherein the FET includes a source (73), a drain (75), and a gate (93). The structure further includes a first layer (83) of cobalt disilicide on the source, a second layer (85) of cobalt disilicide on the drain, and a third layer (91) of cobalt disilicide on the gate. The first layer has substantially no cobalt monosilicide, and the first layer has essentially no stringer of an oxide of titanium thereon. The second layer has substantially no cobalt monosilicide, and the second layer has essentially no stringer of an oxide of titanium thereon. The third layer has substantially no cobalt monosilicide, and the third layer has essentially no stringer of an oxide of titanium thereon. The first layer of cobalt disilicide, the second layer of cobalt disilicide, and the third layer of cobalt disilicide are each in contact with a reagent comprising water, ammonium hydroxide, and hydrogen peroxide. See FIG. 18 and specification, page 14, lines 3-16.

GROUND OF REJECTION TO BE REVIEWED ON APPEAL

1. Claims 27, 33-34 and 39-44 stand rejected under 35 U.S.C. §102(b) as allegedly anticipated by or, in the alternative, under 35 U.S.C. §103(a) as allegedly obvious over Raaijmakers (U.S. Patent 4,908,331).

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ARGUMENT

GROUND OF REJECTION 1

Claims 27, 33-34 and 39-44 stand rejected under 35 U.S.C. §102(b) as allegedly anticipated by or, in the alternative, under 35 U.S.C. §103(a) as allegedly obvious over Raaijmakers (U.S. Patent 4,908,331).

The Examiner rejected claims 27, 33-34 and 39-44 under 35 U.S.C. §102(b) as allegedly anticipated by or, in the alternative, under 35 U.S.C. §103(a) as allegedly obvious over Raaijmakers (U.S. Patent 4,908,331).

Appellants respectfully contend that claims 27 and 34 are not unpatentable over Raaijmakers under 35 U.S.C. §102(b) or 35 U.S.C. §103(a), because Raaijmakers does not teach or suggest each and every feature of claims 27 and 34.

A first example of why claims 27 and 34 are not unpatentable over Raaijmakers is that Raaijmakers does not teach or suggest the feature: “wherein the layer of cobalt disilicide is in contact with a reagent comprising water, ammonium hydroxide, and hydrogen peroxide” (claim 27); and “wherein the first layer of cobalt disilicide, the second layer of cobalt disilicide, and the third layer of cobalt disilicide are each in contact with a reagent comprising water, ammonium hydroxide, and hydrogen peroxide” (claim 34).

The Examiner does not even allege that and Raaijmakers teaches or suggests the

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preceding feature of claims 27 and 34. Instead, the Examiner argues that:

“The terms "the layer of cobalt disilicide is in contact with a reagent comprising water, ammonium hydroxide, and hydrogen peroxide", "not adapted to chemically react", "4 percent of a total reagent volume of the reagent" and temperature with a range of about 45 degrees Celsius to about 95 degrees Celsius" are method recitations in a device claimed. Note that only the final product is relevant, not the method of making. A product by process claim is directed to the product per se, no matter how actually made. See also MPEP 2113. Moreover, an old or obvious product produced by a new method is not a patentable product, whether claimed in "product by process" claims or not. Also note that at the final structure, as shown in Figures 10 and 18 of the present invention, there is no reagent in contact with the cobalt disilicide. Therefore the limitation of reagent is really recited in the intermediate step of forming the cobalt disilicide.”

In response, Appellants contend that the preceding limitation of claims 27 and 34 is not a product by process limitation. Claims 27 and 34 are claiming a structure and the preceding limitation (“wherein the layer of cobalt disilicide is in contact with a reagent comprising water, ammonium hydroxide, and hydrogen peroxide”) is a structural limitation of the claimed structure. The preceding limitation of claims 27 and 34 does not describe a process by which any claimed product is formed.

A second example of why claims 27 and 34 are not unpatentable over Raaijmakers is that Raaijmakers does not teach or suggest the feature: “wherein there is essentially no stringer of an oxide of titanium on the layer of cobalt disilicide” (claim 27); and “a second layer of cobalt disilicide ..., and said second layer having essentially no stringer of an oxide of titanium thereon”

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(claim 34)".

The Examiner argues: "Absent of evidence to the contrary it is held that there is no oxide of titanium on the layer of cobalt disilicide. Therefore, there won't be any stringer of an oxide of titanium on the layer of cobalt disilicide."

In response, Appellants contend that the Examiner has not applied a correct legal test for determining whether or not teaches or suggests the feature: "wherein there is essentially no stringer of an oxide of titanium on the layer of cobalt disilicide".

Under 35 U.S.C. §102(b), the correct legal test is whether Raaijmakers explicitly or inherently teaches or suggests the feature: "wherein there is essentially no stringer of an oxide of titanium on the layer of cobalt disilicide". Appellants contend that Raaijmakers does not explicitly teach said feature, and the Examiner has not alleged that Raaijmakers explicitly teaches said feature.

Appellants contend that Raaijmakers does not inherently teach said feature, since under case law, the alleged inherency must **necessarily and inevitably** follow from the teachings in the prior art. See *The Toro Co. v. Deere & Co.*, 355 F.3d 1313, 1320 (Fed. Cir. 2004) (holding that "the district court did not address a critical question for inherent anticipation: whether ... practicing the '516 patent necessarily featured or resulted in limitation (c) of the '168 patent."). See *Glaxo Inc. v. Novopharm Ltd.*, 52 F.3d 1043, 34 U.S.P.Q.2d 1565 (Fed. Cir. 1995) (holding that ranitidine hydrochloride is not inherently disclosed in its Form 2 crystalline polymorph in Example 32 of Plaintiff's prior patent which disclosed a method of making Form 1

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crystalline polymorph, wherein Defendant practiced Example 32 of the prior patent 13 times and always made Form 2 crystals, but wherein Plaintiff made Form 1 only once by practicing Example 32).

As to inherency, the “Related Art” section of Appellants’ specification on page 1, line 15 - page 2, line 6 states:

“In the formation of cobalt disilicide, it is well known to utilize a layer of cobalt as a source for the cobalt disilicide and to use a titanium nitride (TiN) capping layer to protect the cobalt from oxidizing during a subsequent annealing step. After a first annealing step, this sacrificial TiN capping layer is chemically removed by a selective etch with a solution such as one comprising hydrogen peroxide. Discrete portions of the TiN cap are not always removed by this process, however, and a residual configuration, or “stringer,” of one or more oxides of titanium, such as titanium dioxide, may remain after the cobalt disilicide is formed in a second annealing step. Unfortunately, the stringer of a titanium oxide is electrically conductive and may cause electrical shorting of adjacent structures. For example, the stringer may cause a short between the gate and the drain of an FET, between the source of a first FET and the drain of a second FET, or between the drain of an FET and external circuitry. **The prior art does not disclose a method of removing a stringer of an oxide of titanium that is generated** as described above.” (emphasis added)

Since Raaijmakers does not exclude “use of a titanium nitride (TiN) capping layer to protect the cobalt from oxidizing during a subsequent annealing step”, Appellants maintain that it does not **necessarily and inevitably** follow from the teachings in Raaijmakers that a stringer of an oxide of titanium is not formed on the layer of cobalt disilicide.

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Under 35 U.S.C. §103(a), the correct legal test is whether it is obvious that “there is essentially no stringer of an oxide of titanium on the layer of cobalt disilicide” in Raaijmakers’ structure. In light of the preceding quote from Appellants’ specification on page 1, line 15 - page 2, line 6, and since Raaijmakers does not exclude “use of a titanium nitride (TiN) capping layer to protect the cobalt from oxidizing during a subsequent annealing step”, Appellants maintain that it is not obvious that “there is essentially no stringer of an oxide of titanium on the layer of cobalt disilicide” in Raaijmakers’ structure. Appellants reiterate that following statement on page 2, lines 4-6 of Appellants’ specification: “The prior art does not disclose a method of removing a stringer of an oxide of titanium that is generated.”

Based on the preceding arguments, Appellants respectfully maintain that in condition for allowance. Since claims 39-41 depend from claim 27, Appellants contend that claims 39-41 are likewise in condition for allowance. Since claims 33 and 42-44 depend from claim 34, Appellants contend that claims 33 and 42-44 are likewise in condition for allowance.

In addition with respect to claims 39 and 42, Raaijmakers does not teach or suggest the feature: “wherein the reagent is not adapted to chemically react with the layer of cobalt disilicide” (claim 39); and “wherein the reagent is not adapted to chemically react with the first layer of cobalt disilicide, wherein the reagent is not adapted to chemically react with the second layer of cobalt disilicide, and wherein the reagent is not adapted to chemically react with the third layer of

cobalt disilicide” (claim 42).

The Examiner alleges that the preceding feature of claims 39 and 42 is a product by process limitation.

In response, Appellants the preceding limitation of claims 39 and 42 is not a product by process limitation. Claims 39 and 34 are reciting a property of the reagent not being adapted to chemically react with the layer of cobalt disilicide, which is not a product by process limitation.

In addition with respect to claims 40 and 43, Raaijmakers does not teach or suggest the feature: “wherein the ammonium hydroxide comprises approximately 4 percent of a total reagent volume of the reagent, and wherein the hydrogen peroxide comprises approximately 4 percent of the total reagent volume”.

The Examiner alleges that the preceding feature of claims 40 and 43 is a product by process limitation.

In response, Appellants contend that the preceding limitation of claims 40 and 43 is not a product by process limitation. Claims 40 and 43 are reciting a 4 percent volumetric concentration of both the ammonium hydroxide and the hydrogen peroxide in the reagent, which is not a product by process limitation.

In addition with respect to claims 41 and 44, Raaijmakers does not teach or suggest the feature: “wherein the reagent is at a temperature within a range of about 45 degrees celsius to

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about 95 degrees celsius”.

The Examiner alleges that the preceding feature of claims 41 and 44 is a product by process limitation.

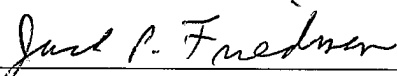
In response, Appellants contend that the preceding limitation of claims 41 and 44 is not a product by process limitation. Claims 41 and 44 are reciting the reagent being at a temperature within a range of about 45 degrees celsius to about 95 degrees celsius, which is not a product by process limitation.

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SUMMARY

In summary, Appellants respectfully requests reversal of the June 4, 2003 Office Action rejection of claims 27, 33, 34 and 39-44.

Respectfully submitted,



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APPENDIX A - CLAIMS ON APPEAL

27. A structure, comprising a layer of cobalt disilicide and a layer of silicon, wherein the layer of cobalt disilicide is on the layer of silicon, wherein the layer of cobalt disilicide is substantially free of cobalt monosilicide, wherein there is essentially no stringer of an oxide of titanium on the layer of cobalt disilicide, and wherein the layer of cobalt disilicide is in contact with a reagent comprising water, ammonium hydroxide, and hydrogen peroxide.

33. The structure of claim 34, further comprising:

 a first insulating structure bordering a side of the source and bordering a side of the first layer of cobalt disilicide; and

 a second insulating structure bordering a side of the drain and bordering a side of the second layer of cobalt disilicide.

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34. A structure having a substrate, wherein the substrate includes:

an insulated-gate field effect transistor (FET), wherein the FET includes a source, a drain, and a gate;

a first layer of cobalt disilicide on the source, said first layer having substantially no cobalt monosilicide, and said first layer having essentially no stringer of an oxide of titanium thereon;

a second layer of cobalt disilicide on the drain, said second layer having substantially no cobalt monosilicide, and said second layer having essentially no stringer of an oxide of titanium thereon; and

a third layer of cobalt disilicide on the gate, said third layer having substantially no cobalt monosilicide, and said third layer having essentially no stringer of an oxide of titanium thereon, wherein the first layer of cobalt disilicide, the second layer of cobalt disilicide, and the third layer of cobalt disilicide are each in contact with a reagent comprising water, ammonium hydroxide, and hydrogen peroxide.

39. The structure of claim 27, wherein the reagent is not adapted to chemically react with the layer of cobalt disilicide.

40. The structure of claim 27, wherein the ammonium hydroxide comprises approximately 4 percent of a total reagent volume of the reagent, and wherein the hydrogen peroxide comprises

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approximately 4 percent of the total reagent volume.

41. The structure of claim 27, wherein the reagent is at a temperature within a range of about 45 degrees celsius to about 95 degrees celsius.

42. The structure of claim 34, wherein the reagent is not adapted to chemically react with the first layer of cobalt disilicide, wherein the reagent is not adapted to chemically react with the second layer of cobalt disilicide, and wherein the reagent is not adapted to chemically react with the third layer of cobalt disilicide.

43. The structure of claim 34, wherein the ammonium hydroxide comprises approximately 4 percent of a total reagent volume of the reagent, and wherein the hydrogen peroxide comprises approximately 4 percent of the total reagent volume.

44. The structure of claim 34, wherein the reagent is at a temperature within a range of about 45 degrees celsius to about 95 degrees celsius.

Docket No.: BU9-98-183-US2

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APPENDIX B - EVIDENCE

There is no evidence entered by the Examiner and relied upon by Appellant in this appeal.

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APPENDIX C - RELATED PROCEEDINGS

There are no proceedings identified in the "Related Appeals and Interferences" section.

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